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(54) AUTOMATIC PROGRAMMING DEVICE AND METHOD

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(56) References Cited

U.S. PATENT DOCUMENTS

(Continued)

FOREIGN PATENT DOCUMENTS

CN 102473009 A 5/2012 JP 06-210544 A 8/1994

(Continued)

OTHER PUBLICATIONS

Kaymakci, M., Z. M. Kilic, and Y. Altintas. "Unified cutting force model for turning, boring, drilling and milling operations." International Journal of Machine Tools and Manufacture 54 (2012): 34-45.*

(Continued)

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(57) ABSTRACT

An automatic programming device includes: a machiningarea-shape generation unit that generates machining-area shape data that is a machining area shape machined on the basis of machining-area data; and a chamfering tool-path generation unit that, when the machining area shape is a chamfering target part, generates chamfering tool-path data for chamfering according to chamfering data including the machining-area shape data, data on tool-to-be-used, and data on machining condition. When performing chamfering on a boundary of the shaped raw material and the machining area shape defined on a curved surface that is a shaped raw material, the chamfering tool-path generation unit generates a machining path, as the chamfering tool-path data, for realizing chamfering by using 2-axis machining of a rotating axis parallel to a central axis of the shaped raw material and with a linear axis parallel to a bottom surface of the machining area shape.

5 Claims, 15 Drawing Sheets

